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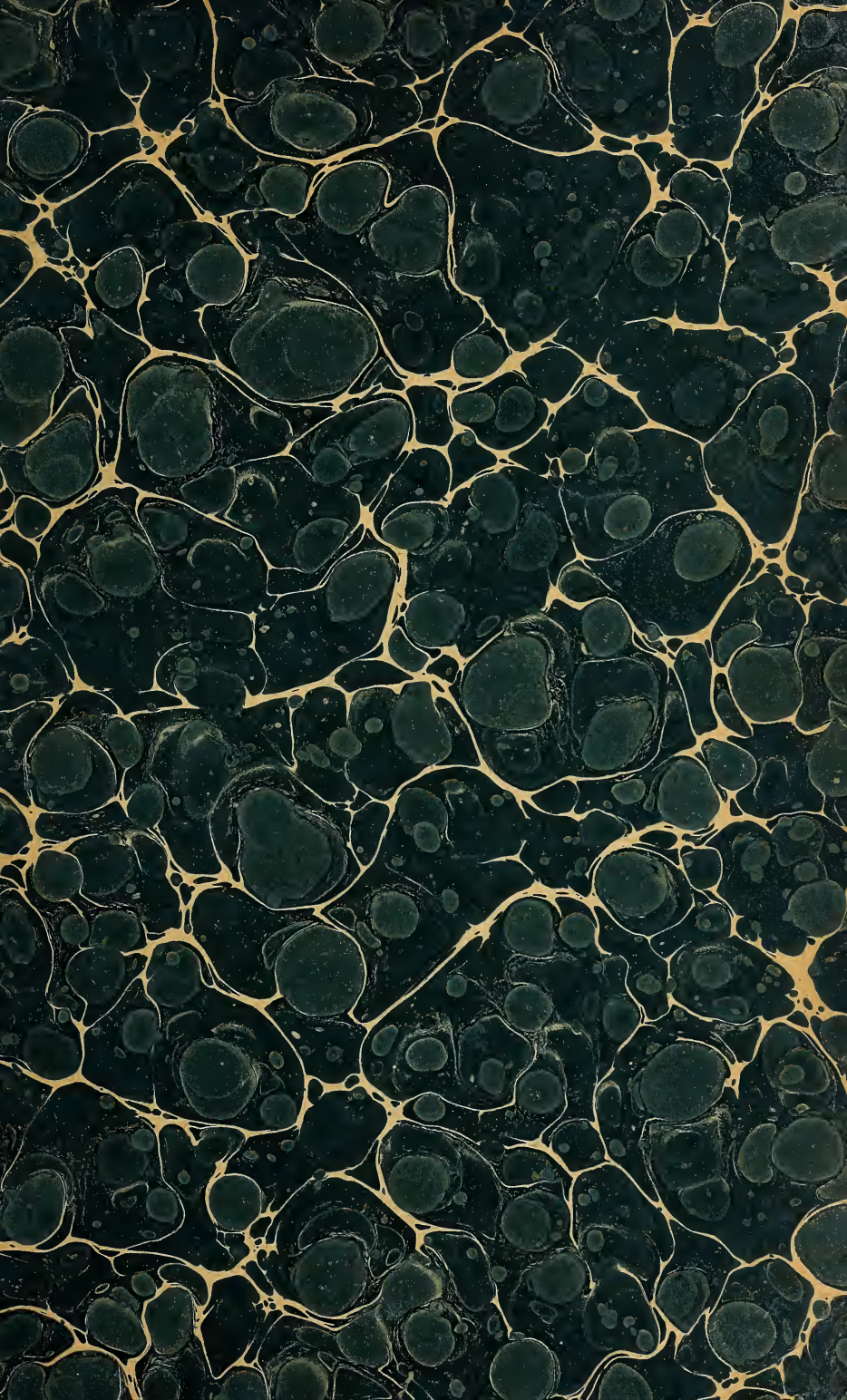

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L. O. HOWARD, Entomologist and Chief of Bureau.

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THE WHITE-PINE WEEVIL.[1]

By A. D. HOPKINS,
In Charge of Forest Insect Investigations.

The Bureau of Entomology has been conducting systematic and economic investigations of the weevils infesting the bark of the trunk and terminal shoots of conifers in the United States, the results of which will be published in the regular technical and popular bulletins; but since

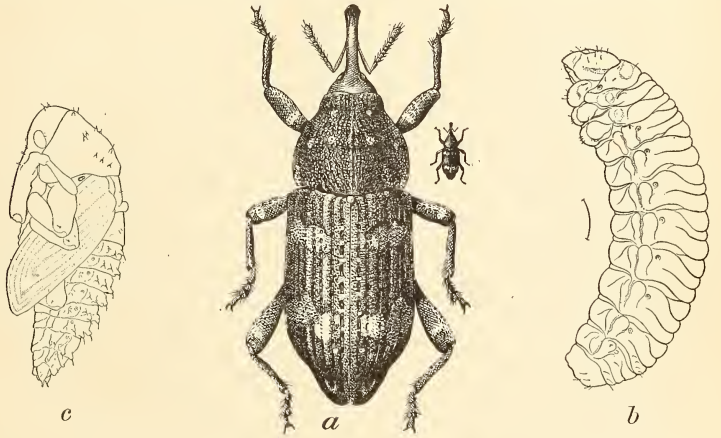

FIG. 1.—White-pine weevil (*Pissodes strobi*): *a*, Adult, smaller figure natural size; *b*, larva, line at left natural length; *c*, pupa, small figure of adult showing natural size. (Original.)

these can not be issued in time to be of service this season, this circular has been prepared to give the information which is of immediate practical importance in regard to one of the most destructive of these weevils.

THE INSECT AND ITS HABITS.

The white-pine weevil is a somewhat elongate, brownish snout beetle, 4 to 5 mm. in length, having the thorax and elytra marked with irregular spots of brown and white scales (fig. 1, *a*). The winter is passed in the adult stage, evidently in the ground. The beetles come out of their winter quarters and fly early in May, and after feeding for a few days on the bark of the living white-pine terminal shoots deposit their

[1] *Pissodes strobi* Peck; Order Coleoptera, Family Curculionidæ.

eggs in punctures in the bark of the shoot of the previous year's growth, placing one or two eggs in a pit or cavity in the inner bark made by the beak of the mother beetle. In from six to ten days the eggs begin to hatch into small white grubs (larvæ), which at first are usually found in large numbers feeding upon the inner bark and cambium (see fig. 2). They usually work downward and sometimes extend their work into the bark of the 2-year-old stem and base of the branches. By the time the larvæ have completed their development (fig. 1, *b*) they are greatly reduced in numbers by natural enemies and other causes. The survivors burrow into the wood or pith of the terminal and excavate individual transformation cells, which they line and cover with excelsior-like borings. In these cells they transform to pupæ (see fig. 1, *c*) and adults, and during July and August of the same year, when the adults are fully matured, they bore their way out and seek suitable places in which to pass the winter.

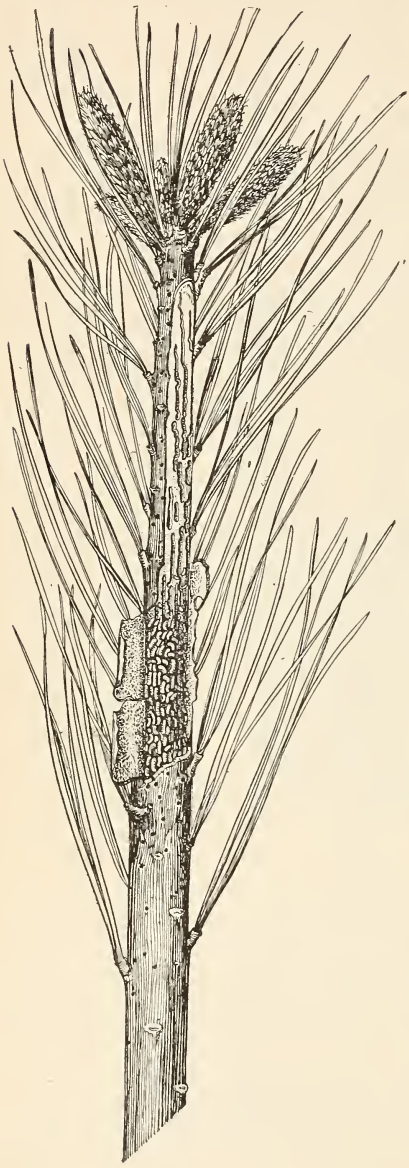

FIG. 2.—White-pine weevil: Newly hatched larvæ at work in vigorous terminal shoot of white pine. (Author's illustration.)

LONG LIFE OF THE ADULT.

From recorded observations on some species of Pissodes or bark weevils by investigators in Europe, and on representatives of other allied forms in Europe and in this country, it appears that an individual adult may live two or three years and will deposit eggs each year.

SEASONAL HISTORY.

The beetles are active from about the 1st to the 15th of May or later, depending on local conditions and weather. Eggs are evidently deposited during the principal activity of the adults, possibly during the greater part of the month of May. The

period of development of the larvæ varies greatly. Those more fortunate in securing a continuous food supply may become fully developed before some of the less fortunate ones in the same terminal are one-fourth as large, although the eggs from which both came may have been deposited at about the same time. There is also a wide range in the period of transformation to the pupa and adults and again in the emergence of the latter. Thus, if the first eggs are deposited about the 8th of May at Milford, Pa., latitude 41° 20′, altitude 500 to 1,000 feet, the first eggs will begin to hatch about the 14th of May, the first larvæ will be full grown about July 8, the first transformations to the pupæ will take place about the 15th of July, the first adults will begin to emerge about July 25, and adults will continue to come out until the first part of September. Practically all will be out by September 15. The principal period of emergence, however, is from about the 25th of July to the middle of August.

KINDS OF TREES ATTACKED.

The white pine is the tree normally attacked, but the weevil is occasionally found in the terminals or topmost branches of the native and cultivated spruces, the jack pine, and very rarely in the pitch pine or other eastern pines. The attack is confined to the small to large sapling and pole stages in the development of the tree.

DISTRIBUTION.

Our records indicate that this weevil follows the natural range of the white pine from southwestern North Carolina into New Brunswick and Canada and westward into Wisconsin.

EVIDENCE OF ATTACK.

The first evidence of attack on the living terminals is the exudation of fresh, clear, and shining drops of resin. Upon closer examination fresh pinhole-like punctures are found in the bark (fig. 3), and at the same time the inconspicuous beetles may be found on the terminal; but upon the approach of the observer the beetles will often let go their foothold and fall to the ground, where they will feign death. In a few days after the first attack the injured terminals will have the resin more or less abundant and conspicuous over the greater part of the surface. The first evidence that the terminals are infested with larvæ is the stunted, unhealthy appearance of the young growth at the tip, which will gradually die, the needles turning yellowish and later brownish.

The time of development of the broods to adults will be indicated by the first appearance of dead tips.

Old work of the weevil is evidenced by the presence of old dead ter-

FIG. 3.—Work of white-pine weevil, showing character of injury, chip cocoons, and pupal cells: *a*, Vigorous terminal shoot, showing condition of new growth at time pupæ are transforming to adults; *b*, 3-year-old top, showing how larvæ have migrated from terminal to the 2 and 3 year old internodes; *c*, chip cocoon and pupal cell, natural size. (Original.)

minals in the forks of the young trees (fig. 4), and the results of their work will be evident in the deformed growth, large forks, and broad, low crowns of both young and old trees (fig. 5).

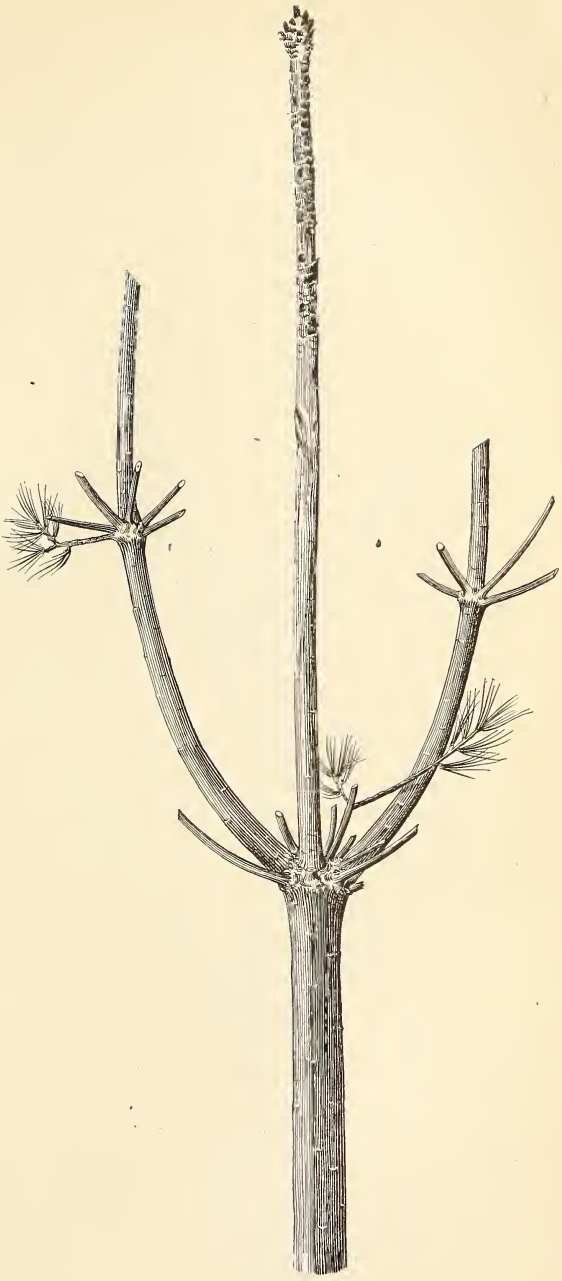

FIG. 4.—Work of white-pine weevil, showing result of killed terminal shoot in 4-year-old top of small sapling. (Original.)

CHARACTER OF THE DAMAGE.

The damage and loss, as affecting the commercial tree, consists not only in the death of the terminal shoots, but in subsequent abnormal development of the trees so injured. The dying of the leading shoot throws the next year's growth into the upper lateral shoots, which results in a forked and many-branched top. Each branch produces a vigorous terminal, and all compete for leadership in forming the crown. In succeeding years the more vigorous terminals of the topmost branches are attacked and killed, causing more branches, and thus effectually preventing the development of the normal straight trunk and symmetrical crown necessary to a tree of commercial value.

EXTENT OF DAMAGE.

The extent of damage, as affecting natural reproduction, plantations, and timber of commercial size in the forest, is difficult to estimate; but it is an important item to be charged to the losses in commercial growth of white pine and is therefore a forestry problem which must demand special attention in the future management of woodlots and forests, wherever the tree predominates.

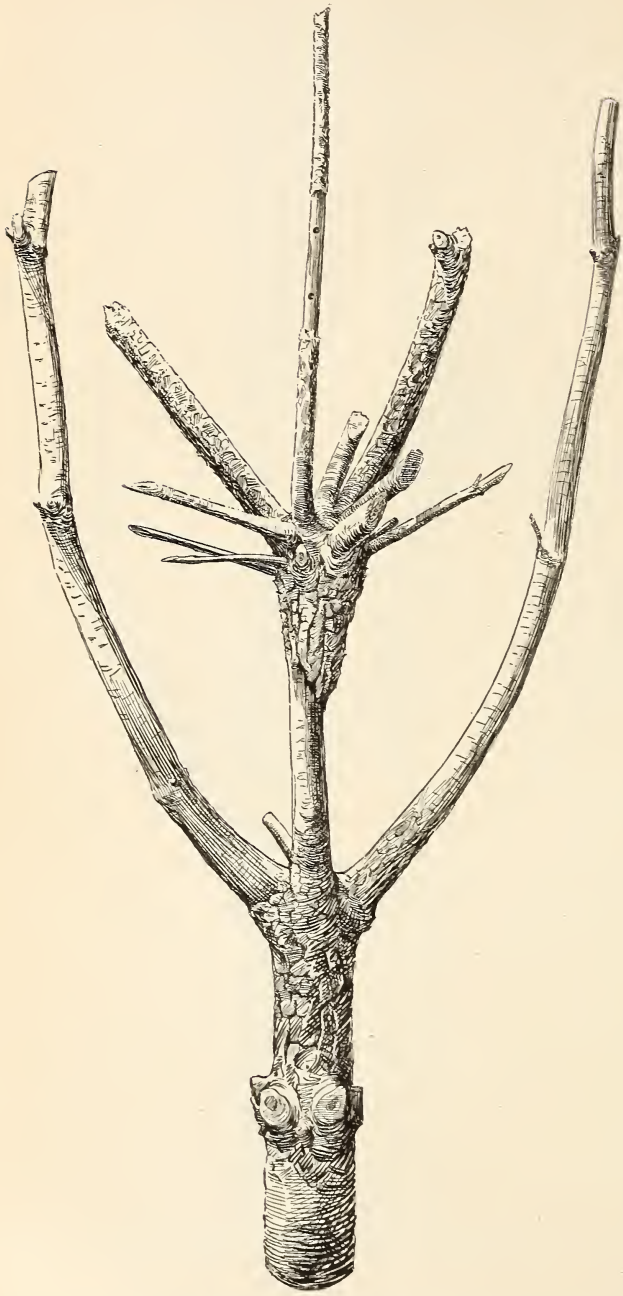

FIG. 5.—Work of white-pine weevil, showing result of killed terminal shoot in 8-year-old top of large sapling. (Original.)

FAVORABLE AND UNFAVORABLE CONDITIONS FOR DESTRUCTIVE WORK BY THE WEEVIL.

The most favorable condition for serious injury by this weevil consists in a scattering or open pure stand of young white pine where the growth is healthy and rapid, such as is found in open plantations, in abandoned fields, and around the bor-

ders of dense stands wherever the soil and other conditions are most favorable for rapid growth.

The unfavorable conditions for injury are slow growth, dense pure stands, and mixed stands of pine and hardwood.

Under the former conditions the thrifty, vigorous terminals are especially favored as breeding places for the weevil; and where these are killed, the vital energy of the tree is thrown into the lateral branches. Open stands, therefore, favor the development of large branches and a spreading crown, while under conditions unfavorable to weevil injury the terminals are smaller and, even if they are killed, the close stand or lateral shade will tend to produce an upward or vertical growth of the topmost branches, the stronger one taking the lead and soon repairing the damage.

NATURAL ENEMIES.

Numerous parasitic and predatory insect enemies attack the developing broods in the terminals. Woodpeckers, also, feed on the matured

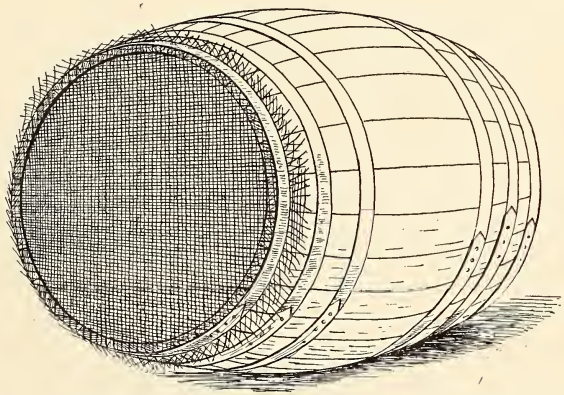

FIG. 6.—Barrel for terminal shoots infested by white-pine weevil, with wire screen over end allowing escape of parasites but preventing escape of weevils. (Original.)

larvæ, pupæ, and adults. Some of the larvæ apparently die from disease, and when large numbers of them are crowded together the larger ones appear to feed on the smaller ones, so that on the average not more than from 3 to 5 per cent of the hatched larvæ ever reach maturity and emerge from the infested terminals. However, each female is capable of depositing more than one hundred eggs each year for several years; thus the depredations are continuous. During some years the damage will be slight, while in other years it will be very severe, the amount of injury depending on the number of adults that survive and the conditions presented for their attack and development.

METHODS OF CONTROL.

It will be seen that in the successful control of this pest, as in the control of forest insects in general, much depends on special features in

the general methods of forest management which will bring about unfavorable conditions for injury and thus prevent loss.

It will also be seen how important it is to know the principal facts in regard to the life history and habits of the insect, in order to secure the best results from methods of management and of direct control.

Heretofore this species has been confused with another species with very different habits, and some of the published data and recommendations based on such confusions are of no value.

The white-pine weevil rarely, if ever, passes the winter in the terminals. The present evidence indicates that it never breeds in the thick bark on the trunks and stumps of the white pine or other pines; thus it can not be trapped in the trunks of felled and girdled pine.

DESTRUCTION OF THE BROODS.

The only practical method of destroying the weevil appears to be the treatment of the infested terminals, and to secure the best results special attention must be given to certain important details.

If the infested terminals are cut or broken during June and July and burned, the broods of the weevil will be effectually destroyed, but vast numbers of natural enemies will also be destroyed. A better method is to collect the terminals during the first half of July before the beetles begin to emerge and to place them in tight barrels securely covered with wire fly-screen netting on one or both ends (see fig. 6). The barrels should be left in the groves, so that the parasites and other enemies may escape, while the beetles perish. After the 1st of October the weevils will all be dead, and the netting may then be removed, although the barrels with their contents should be left until the following June to allow the escape of the later developing and larger parasites. The barrel should not be placed in a position to collect rain. It is necessary, however, if this method be adopted, that it be repeated two or three years in succession in the same locality, in order to catch the successive broods from the old parent beetles that live over from preceding years.

NOTE.

The statements and recommendations in this circular are based on recent observations and investigations by the author and by Field Assistant W. F. Fiske, and serve as a partial revision of what has hitherto been published.

Approved:

JAMES WILSON,

Secretary of Agriculture.

WASHINGTON, D. C., *May 21, 1907.*

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